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Observations on the Pilot Control of *Senna spectabilis*, an Invasive Exotic Tree in the Mahale Mountains National Park, Western Tanzania

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INTRODUCTION

Senna (*Cassia*) *spectabilis* (DC) Irwin & Barneby is a native tree of central and southern America (3). Although the damage that many invasive exotics do has been fairly well documented (e.g. 2), there appears to be little such information for *Senna spectabilis*. However, the aggressive growth habits of *S. spectabilis*, even in infertile soils, has been noted (1,6). Ladha *et al*. (4), concluded that *S. spectabilis* is unable to fix atmospheric nitrogen and that its extensive root system enables it to tap nitrogen from deep soil horizons. It has the tendency to readily naturalize in arborescent forests, particularly disturbed habitats and in at least one case, it escaped from Trinidad and Tobago and aggressively colonized the northern periphery of Orinoco in Venezuela (3).

The plant is also suspected to have allelopathic properties (Ohigashi, pers. comm.). However, under controlled agronomic conditions, it was not found to be allelopathic to maize and rice (6). Mahale is home to at least nine primate species but currently more than 2.5km^2 of its forest is infested by *S. spectabilis* and invasion is on the increase. The ecological implications of this invasion and the urgent desire to restore the degraded portion has prompted systematic research in recent years. Here, I report on a 12 month (March 1996-April 1997) pilot comparison of girdling versus total cutting as control alternatives for *S. spectabilis* at Mahale.

METHODS

Total cut and girdling was compared in a 100m x 100m area taken over by Senna. Half of this area was cleared of all Senna trees and saplings. In another half, clearing was done for Senna of DBH 10cm while trees larger than this (N=209) were carefully debarked from just below soil level to about 60cm up the trunk. It was done thoroughly to ensure reasonable destruction of phloem tissues.

An additional 150m x 100m was marked as a control plot and contained 198 mature *Senna* trees. After clearing, we enriched the intervened plots with seedlings of *Khaya anthoceca, Milicia excelsa, Cordia africana* and *Albizia glaberrima* at a spacing of 5m x 5m. Regular weeding was then done to remove both the emerging *Senna* seedlings and sprouts. Activities were done manually by using simple tools i.e. machetes, axes and hoes.

We monitored the plots with respect to *Senna* germination, wilting and flowering. We also recorded the level of natural tree recolonisation in the experimental plots and monitored animal activity with a focus on destruction of artificially transplanted seedlings. For the first 3 months post treatment, on a daily basis, we timed and recorded visits of individual animal species plus their major activity within the first 10 minutes in the plots. Each species was recorded once per day even if multiple visits occurred. Activities were classified as feeding (including destruction of transplants), traveling and others.

RESULTS

While all 198 control plot trees flowered for two successive seasons (i.e. 3 months and 11months post girdling respectively), the rate for the girdled trees to flower (i.e. no. flowering/total no. trees) dropped from 87% to 9% in the corresponding seasons. *Senna* soil seed reserve, estimated by frequency of regermination after successive clearing, was slightly higher in the girdled plot (8 germination) as compared to the totally cut plot (6 germination). Mean interval for succeeding germination after each clearing was between 3-4 weeks.

Even though sprouting in the total cut plot was profuse during the first 3 months, it later ceased and almost all the buttresses dried up completely after about 6 months. Animals observed in the area were bushbucks (*Tragelaphus scriptus*), vervet monkeys (*Cercopithecus aethiops*), red tailed monkeys (*Cercopithecus ascanius*), warthogs (*Phacochaerus aethiopicus*) and yellow baboons (*Papio cynocephalus*).

A total of 133 visiting bouts by animals of these species were recorded. Baboons and warthogs were both the most regular visitors and their combined visits accounted for 79% of time spent in destruction of artificial transplants followed by vervet monkeys(15%) All destruction occurred within 3 weeks of transplantation. Although animal activity data lacks control comparisons, our experience suggests that there was increased animal activity after we cleared the forest. There was little natural tree germination in the plots prior to clearing. However, roughly one year later, natural germination occurred in about half of the cleared area, a phenomenon which was not observed in the control plot. Surprisingly, unlike artificial transplants, these were less tampered with by animals. At least nine tree species pioneered natural recolonization in both the comparison plots. The most abundant, however, were *Pseudopondias microcarpa* (ANACARDIACEAE), *Harungana madagascariensis* (Poir) (GUTTIFERAE), *Saba florida* (*Benth*) Bullock (APOCYNACEAE) and *Trema orientalis* (L) Blame (ULMACEAE.) It should be noted that these species also occurred in the adjacent control plot as well, as also observed by Nishida (7) albeit at low densities.

DISCUSSION

While both girdling and total cutting may work as control alternatives, they are, however, costly and time demanding, a feature common to most ecological restoration strategies (2). We used most resources in the management of *Senna* soil seed reserves, a fact we could not foresee at the start of the experiment. For example, while we spent only a few days to fell the large trees using a power chainsaw, we spent about 8 months to exhaust the seedbank by weeding. Earlier efforts to control *Senna* at Mahale by cutting or girdling were futile mainly due to profuse sprouting thereafter (personal observation) and recently Lukosi (5), has reasoned that in such cases girdling was not systematic. In our case, *Senna* sprouting ceased within the reporting period, only after constant weeding. It follows therefore that launching of large scale eradication should be preceded by accumulation of relevant facts, as also noted by Turner (8).

Artificial seedling transplantation could not work as transplants were immediately destroyed by animals. Cleared patches in the forest attract animals to the exposure to more sunlight and/or sprouts of tender plants. Anticipated consequence of such a phenomenon is a disproportionate increase in herbivory on germinating tender seedlings as happened to our artificial transplants. It remains unclear, why this tampering was biased to artificial transplants. Since *Senna* infestation in Mahale dates back more than 20 years, it also remains obscure if the natural seeds that germinated were from animal droppings or were from dormant soil reserves. Alternative ways of managing the *Senna* soil seed reserve should be a priority for future research. Similarly, evidence for Senna allelopathy to natural vegetation at Mahale needs to be investigated in more detail.

CONCLUSIONS

1. Controlling *Senna* by cutting or girdling is not only tedious and costly but also requires long term monitoring.
2. Girdling effectively lowers flowering by 90% after about 12 months during which time there is also additional seed production unlike cut trees.
3. Animals destroy most transplanted seedlings into the area and may hamper artificial tree transplantation.
4. There may be enough native tree germination in a cleared area after at least 12 months, following constant weeding of *Senna*.
5. *Senna* seedbank poses a far greater problem. To clear the seedbank requires at least 8 successive removals of seedlings, at intervals of between 3-4 weeks.

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